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E7.3 10809

CR-133293

TYPE 1 REPORT #2

March 3, 1973

- A. TITLE OF INVESTIGATION: Multispectral Signatures in Relation to Ground
Control Signatures Using Nested-Sampling Approach.
- B. PROPOSAL #637: GSFC #UN142
- C. ABSTRACT OF OBJECTIVES: Determine daily seasonal, meteorological, angular
and statistical variation in spectral signatures for different
geological target types; relation, integration and correlation
of data from ground, aircraft, and ERTS radiometric equipment
for the various target types leading to their improved identifi-
cation from ERTS images.
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- F. PERIOD: January 3, 1973- March 2, 1973
- G. ACTION REQUIRED: None

(E73-10809) MULTISPECTRAL SIGNATURES IN
RELATION TO GROUND CONTROL SIGNATURES
USING NESTED SAMPLING APPROACH Progress
Report, 3 Jan. - 2 Mar. 1973 (Stanford
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H. PROBLEMS IMPEDING PROGRESS:

- I. Considerable cloudiness and rain on ERTS overpass days has precluded the collection of field data.

<u>ID</u>	<u>DATE</u>	<u>ERTS "CLOUDS"</u>
1183-18173	1/22/73	20%
1201-18181	2/09/73	80%
1219-18182	2/27/73	100%

Some field data were collected on 1/22/73 which are presented in Section I.

I. DISCUSSION OF ACCOMPLISHMENTS DURING PERIOD:

1. Data System Software

Computer programs were prepared for the ERTS radiometers (EGTR) so that their 4-channel data could be read directly into the computer, along with temperature (or other weather data) and incident flux readings. Several tapes were made observing solar incidence and subsequent temperature (using a PRT-5 thermal radiometer)

A typical output document from a field recording session is shown on Table I.

In this specific example the amplifiers and A - D system are first calibrated by the input of known voltages (3.46 volts into each of the 4 x 4 EGTR channels, and 6.50 mv into the sol-a-meter channel respectively.

Line: 1. 999= calibrate mode ID input-volt
2. 998= calibrate mode ID input-zeros
3-5. Calculation of conversion equative
8-13. Data samples 001-003 contain the following numeric data
001 N = 46 (x4) sample: 21 second recording, means
and standard deviation given
002 N = 40 (x4) sample: 19 seconds
003 N = 44 (x4) sample: 20 seconds
11. 004 N = 60 (x4): 27 seconds, grass, connected channels
voltages 1.523, 2.726, 2.898,
4.059 respectively.
12-13. 005, 006 and so on.

These connected voltages must further be treated in the following steps:

- a. Have the zero-radiance offset algebraically subtracted.
- b. Multiplied by their correction factors (CORF) which convert these new voltages to band pass radiance in watts, $\text{CM}^{-2}\text{STER}^{-1}$ through the band pass of each ERTS filter. (see Figure 1)
- c. To calculate spectral radiance (watts CM^{-2} . STER^{-1} . μm^{-1}) one must divide through by the spectral band pass of the 4 MSS filters. By convention these are determined by seeking the half-bandwidth points (50% transmission and/or system-response lines) and expressing the wavelengths of these points as the "limits" of the filters. In the calcu-

TABLE I

TRIAL DATA FOR ANALYSIS OF METRODATA SYSTEM
EGTR MEASUREMENTS MADE ON 73 01 22 (MORNING)

REFERENCE VOLT 3.44					REFERENCE MILLIVOLT 6.50				(FED IN)					
LINE	ID	NO	TIME ON	TIME OFF	CH 4	CH 5	CH 6	CH 7	SOLRMTR	SD 4	SD 5	SD 6	SD 7	SD GLR
1	999	53	001646	001717	683	683	683	683	768	.475	.452	.464	.471	.320
2	998	67	001730	001800	0	0	0	0	-1.2	0	0	0	0	.430
3	NEW SCALE FACTORS													
4	CHANNELS 1-4 VOLTS = 0.0 + 0.0050 *DIAL													
5	CHANNEL 5 MVOLTS = 0.0 + 0.0084 *DIAL													
7														
8	001	46	001924	001945	0.216	0.292	1.113	1.869	3.864	0	0	.006	.016	.005
9	002	40	002031	002050	.166	.201	.994	1.728	3.895	0	0	.004	.012	.005
10	003	44	002200	002220	.247	.257	1.027	1.642	3.915	0	0	.001	.004	.007
11	004	60	002508	002535	1.523	2.726	2.893	4.059	3.950	.002	.003	.007	.016	.006
12	005	52	002710	002734	2.791	3.653	2.787	3.375	4.021	.006	.008	.009	.017	.009
13	006	57	002941	003031	1.177	1.513	1.309	1.640	3.919	.009	.010	.006	.008	.028
16	004	ROAD SITE GRASS #1 WEND FELT LAKE												
17	005	FIBERFRAX 970JH REFLECTANCE STANDARD, FLAT, HORIZONTAL												
18	006	SKY 2 PI	WITH DIFFUSIVE DISC.											

lation of spectral radiance from band pass radiance the convention is to presume square-pass filters through these points as shown by the dashed lines on Figure I. Table II lists these limits as determined in this manner. These values would be then used for further calculations of spectral response, cited as at the center wavelength of the square filter. In such a convention the shape of a filter, like MSS7 (with a sloping cut off at long wavelengths), becomes quite a question. Intuitively one would presume the curve ABC to be more correct yet for this calculation the edge DBE is to be used. Table II indicates therefore that the bandpass radiance values for channel 7 MSS, must be divided by about 1.7 to become more equal relative to the other 3 channels.

TABLE II

MSS FILTER B AND PASS CALCULATIONS (in nanometers)			
<u>ERTS CHANNEL</u>	<u>50% LIMITS</u>	<u>CENTRAL WAVELENGTH</u>	<u>WIDTH</u>
# 4	498 - 595	546	97
# 5	610 - 703	656	93
#6	696 - 796	746	100
#7	805 - 875	890	170

Data from W. Hovis, GSFC, letter received September 8, 1972, for MSS Engineering model unit.

2. Site selection has continued, selecting large areas of even radiance to be monitored over the 12 month cycle.
3. The EGTR units have a centrally-placed telescopic sight (1x) which enables a constant view to be had of the targets being measured. In a mobile mode it is especially important to be able to locate the ground and also to review local annalous readings relative to the characteristics of the specific terrain. To accomplish this we have rigged a 8-mm movie camera on to a metal base plate so that it can run freely yet still be in the correct optical train to view the targets. Later this will possibly be replaced by a home-type cassette video TV unit.

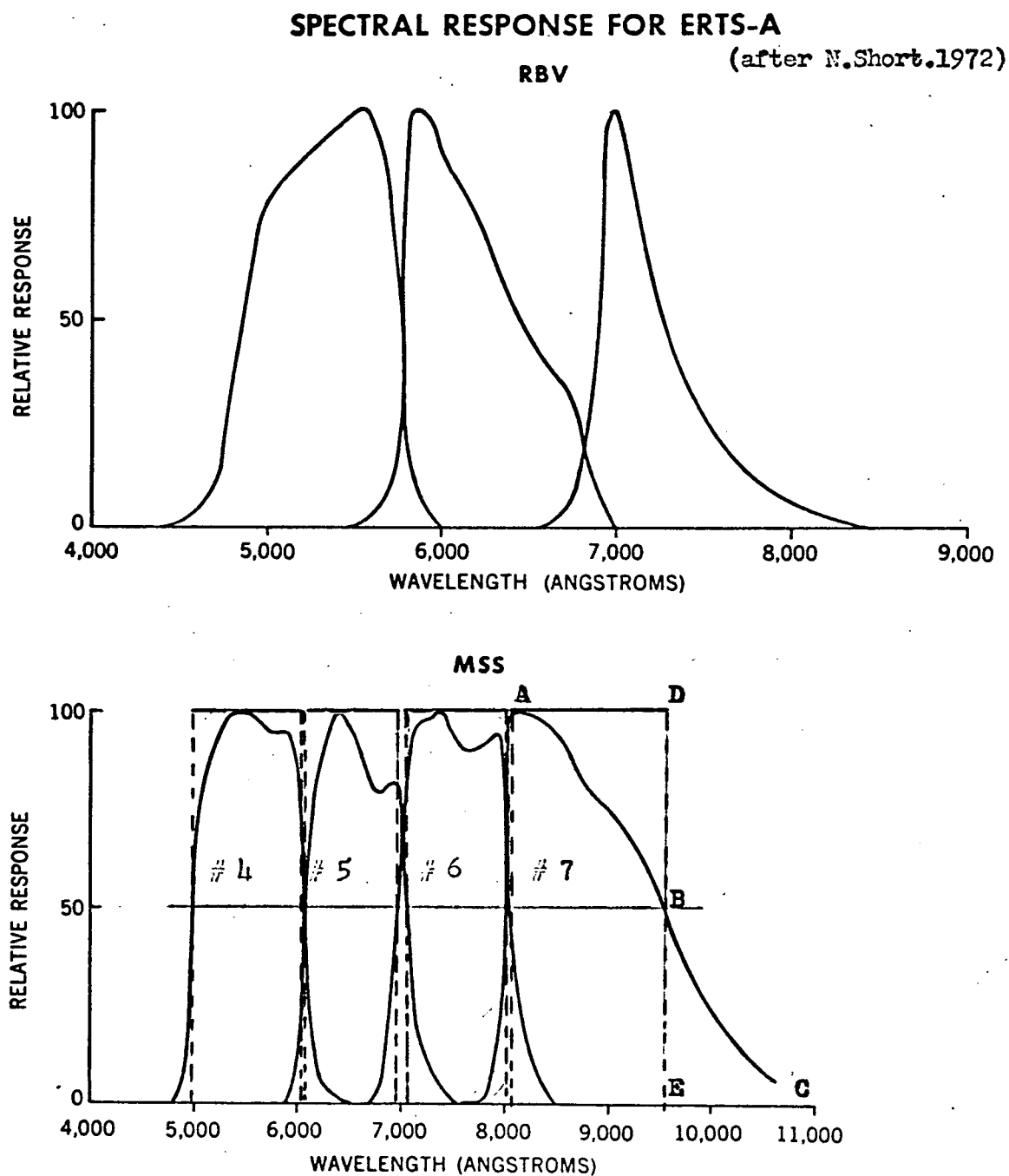


Figure 1

J. SIGNIFICANT RESULTS

(Relationship to applications or operational problems, including estimates of cost benefits of any significant results)

NONE

K. PLANNING FOR NEXT PERIOD

1. Further software development aimed both at reading our own radiometric tapes and also the MSS tapes themselves.
2. Software development for shade-printing selected areas from MSS data tapes (CCT)
3. Sola irradiance and bidirectional reflectance measurements of BASO_4 and Fiberfax 970JH.
4. When weather permits field measurements at the time of ERTS overpass. (see Table III for current status of flight data and imageries.)

L. PUBLISHED MATERIALS

NONE

M. RECOMMENDATIONS FOR CHANGES IN OPERATIONS ADDITIONAL EFFORT OR
CORRELATION OF EFFORT/RESULTS OF ERTS.

NONE

N. CHANGES IN STANDING ORDER FORMS

NONE

O. DATA REQUEST FORMS SUBMITTED

NONE

P. FLIGHT DATA OBTAINED BY ERTS

SEE TABLE III

ERTS IMAGES ACQUIRED OVER STANFORD UNIVERSITY TEST AREA
FROM THE STANDARD CATALOG FOR US 07/24/72 TO 5/31/73

OBSERVATION ID	MICROFILM ROLL NO.	DATE ACQUIRED	CLOUD COVER	ORBIT NUMBER	PRINCIPAL POINT (C) OF IMAGE		SUN ELEV	SUN AZIM	PRODUCTS MADE				PRODUCTS RECD. AT STANFORD						
					LAT	LONG			M	S	B7	P	M9	M	S	B7	P	M9	
2	1021-18172	10001/1226	08/13/72	0	293	3724N	12145W	55.8	124.5	x	x	x	x	x	-	-	-	-	-
3	1039-18172	10002/0074	08/31/72	0	544	3725N	12150W	51.9	132.5	x	x	x	x	x	-	-	-	-	-
4	1057-18172	10002/0598	09/18/72	20	795	3721N	12149W	47.1	140.2	x	x	x	x	x	-	-	-	-	-
5	1075-18173	10004/0236	10/06/72	0	1046	3729N	12144W	41.6	146.8	x	x	x	x	x	4	8	-	1	4
6	1093- NO FRAMES TAKEN																		
7	1111-18181	10004/1570	11/11/72	60	1548	3715N	12153W	30.9	153.9	x	x		x	x	4	8	-	2	-
8	1129-18181	10005/0498	11/29/72	20	1799	3725N	12150W	26.7	154.6	x	x		x	x	4	8	-	2	-
9	1147-18181	10006/0333	12/17/72	90	2050	3718N	12151W	24.5	153.4	x	x		x	x	-	-	-	-	-
10	1165-18175	10006/0898	01/04/73	10	2301	3724N	12146W	24.2	151.1	x	x	x	x	x	4	8	-	2	-
11	1183-18175	10007/0170	01/22/73	20	2552	3732N	12146W	26.3	148.2	x	x	x	x		4	8	-	2	-
12	1201-18181	10007/0782	02/09/73	80	2803	3725N	12151W	30.5	144.9	x	x		x		-	-	-	-	-
13	1219-18182	10008/0440	02/27/73	100	3054	3726N	12156W	36.3	141.6	x	x		x		-	-	-	-	-